International Journal of Disclosure and Governance
https://doi.org/10.1057/s41310-025-00290-7

ORIGINAL ARTICLE

Outside board directors' expertise and intellectual capital disclosure: evidence from FTSE 350 companies

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Received: 12 June 2023 / Accepted: 22 February 2025

Abstract
Recent amendments to statutory reporting regime require the approval of strategic report (SR) by board of directors. As the guidance on SR encourages narrative content of firms' value creation processes, regulators were concerned about the impact of board of directors on corporate transparency. Using content analysis approach upon a sample of nonfinancial UK firms listed in the FTSE 350, this study aims to examine whether expertise diversity of outside directors (ENEDs) on the board promotes intellectual capital (IC) disclosure. Drawing on the dual functions of boards of directors (monitoring and advising), we find that cross-directorship, nonaccounting and academic background are positively associated with level of IC disclosure, in line with agency and resource dependence perspectives. However, this is not the case for firms with more accounting ENEDs on the board. In addition, prior empirical studies have largely focused on IC disclosure in a static sense, while we find that it is the nonaccounting and academic ENEDs that matter to IC disclosure narratives connecting with corporate strategies. Results are robust to the use of alternative variables in board expertise. Our evidence suggests the needs of policymakers to better understand the role of boards of directors in the increasingly rich and complex information environment of corporate voluntary-based reporting. By adopting multiple attributes of IC disclosure narratives, this paper is distinct from what the extant disclosure literature has examined on the association with IC.

Keywords Intellectual capital · Voluntary disclosure · Corporate board expertise · UK strategic report · Non-executive directors · Content analysis

Introduction

Since the last decades, the OECD economies have been more directly driven by their knowledge stock and learning capabilities (Foray and Lundvall 1998). It is thus the shift from physical assets to intellectual items, and intellectual items for value creating and competitive advantage building are generally referred to as 'intellectual capital (IC)' (e.g. Stewart 1997; Roos et al. 1997). Corporate IC disclosure has become an important area of nonfinancial information to convey a firm's value creation processes (Beattie and Smith 2013). Although definitions of IC vary, it contains intangible assets that can be recognised in financial statements and those to be excluded by accounting standards, and is comprised of three categories, namely human capital, structural capital and relational capital (e.g. Sveiby 1997; Edvinsson and Malone 1997; Guthrie and Petty 2000; MERITUM 2002; OECD 2006). MERITUM (2002) further distinguishes IC between static (intangible resources) and dynamic (intangible activities) in the forms of narrative content.

The growing importance of IC in creating firm value and sustaining competitive advantage rises the demand for IC-related information (Guthrie et al. 2012). This is especially the case in the UK where IC investments (e.g. software, R&D, training and organisational capital) in market

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Published online: 02 April 2025

sectors[1] have exceeded tangible assets since 2003 (Martin et al. 2018). The UK finance directors surveyed by Beattie and Smith (2012), in the IC context, are strongly aware of the importance to communicate IC information with external stakeholder groups. While the directors questioned completely agree with the benefits and value of IC disclosure, most of them see the benefits of providing IC information outweighing the costs.

After recent accounting scandals and corporate failures in the UK,[2] both practitioners and regulators of the accounting community have called for greater corporate transparency. Meanwhile, the Financial Reporting Council (FRC) has criticised a lack of clarity and transparency in corporate annual reports and re-emphasised the role of non-executive directors (NEDs, also known as outside directors) for the objective of maximising stakeholders' interests (FRC 2021a). In particular, the board of directors has been required to review and approve the strategic report (i.e. a separate component of the annual report) along with reflecting a collective view of board directors (FRC 2014, 2018a).

Nevertheless, prior evidence suggests that higher board independence is associated with lower voluntary disclosures (e.g. Eng and Mak 2003; Haniffa and Cooke 2005; Tejedo-Romero et al. 2017). A recent study from Nadeem (2020) finds a significant negative impact of independent directors on IC disclosure in China. This is opposite to agency theory predictions and has raised the question of which, other than monitoring functions, may enhance the disclosure of voluntary-based information. On the other hand, Keenan and Aggestam (2001) argue that the governance of IC development depends more on the expertise and attitude of board members than the board structure, especially in knowledge-intensive organisations. Consistent with this view, Gul and Leung (2004) find outside directors' expertise to be a key determinant of increasing voluntary corporate disclosures among Hong Kong companies. Rationally, therefore, companies with higher level of board expertise may have more disclosures on IC and thus reduce information asymmetry between investors and firms in capital markets.

Coping with ineffective monitoring of the board, expertise on corporate board has been attracting great attention from policymakers and academic scholars. The FRC has issued eight editions of the UK Corporate Governance (CG) Code since 2000s and constantly set an explicit goal of having a good combination of skills, knowledge and experience to discharge their duties effectively in the transparency of corporate information (FRC 2003, 2018b). All listed firms in the UK must have at least one financial expertise on the audit committee for monitoring the integrity of corporate reporting (FRC 2018b). Empirically, prior studies have shown that professional expertise on boards is diverse and above a certain requirement, which includes accountants, bankers, engineers, lawyers, business executive, etc., and makes the impact on corporate outcomes (Gray and Nowland 2017).

Research into board expertise has therefore become an interesting area that appears on the researchers' agenda. The vast majority of prior studies have examined the effect of financial or accounting expertise of directors on corporate (and IC) disclosure (Mangena and Pike 2005; Felo 2009; Li et al. 2012; Ahmed Haji and Mohd Ghazali 2013; Bravo and Alcaide-Ruiz 2019; Naheed et al. 2021; Alcaide-Ruiz and Bravo-Urquiza 2023). Although some studies promote understanding on the diversity of board expertise by examining the impacts of law expertise on corporate disclosure (Bozanic et al. 2019; Masud et al. 2019), academic expertise on firm performance (Francis et al. 2015; Nugraha 2023) and financial reporting quality (Trainor and Finnegan 2013), marketing expertise on firm performance (Vandenbroucke, et al. 2016), engineering expertise on firm value (Balogh 2016) and HR expertise on diversity management (Mullins 2018), little is known about the relationship between board expertise diversity and IC disclosure.

The aim of this study is to investigate the relationship between expertise diversity of outside directors (ENEDs) and the information content of IC disclosures. The role of the board of directors is elicited regarding the effectiveness of board functions to the decision to disclose IC information. The setting is the nonfinancial reporting and CG environment of the UK, a developed, market-based and shareholder-orientated country. The UK focuses on protecting the interests of shareholders compared to other developed countries such as France and Germany where the interests of a wide range of stakeholders are centred (Ullah et al. 2021). Such a setting is meaningful for the following reasons. First, the UK is one of the pioneers in developing the principles of a sound firm-level CG environment. Not only does the UK keep pace with leading knowledge economies, but the UK CG code constantly emphasises the importance of expertise diversity on corporate boards and its great impact on information transparency.

Second, strategic report is the latest regime of non-financial reporting in the UK[3]—which provides shareholders with a holistic and meaningful picture of an entity's

[1] Market sectors exclude real estate, public administration and defence, education, and health and social work.

[2] For example, Tesco is the biggest Britain's supermarket that was found to have overstated its profits by £263 m (Hope 2016). Patisserie Valerie overstated its financial position by £94 m (Eley 2019). In addition, the value of fines issued by the UK's FRC to auditing firms was tripled from £16.5 m in 2020/2021 to £46.5 m in 2021/2022 (URL: https://www.frc.org.uk/news-and-events/news/2022/07/frc-reports-record-cases-resolved-and-record-financial-sanctions-of-465m/).

[3] Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013 (URL: https://www.legislation.gov.uk/uksi/2013/1970/contents/made).

business model, development, strategy, position, performance and prospects (FRC 2014). In particular, Bini et al. (2016) viewed the content of SR to be information on how IC shapes the value creation process of a firm. Although the amendments to statutory reporting regime require the approval of SRs by board of directors, the impact of board of directors on the IC disclosure is unknown.

Third, the decision to study FTSE 350 companies is motivated by the evidence-based perspective relevant to diversity in the boardroom. A recent survey reported that FTSE 350 companies embrace a diversity of expertise around the board and use diversity-friendly approach to board recruitment (FRC 2021b). Despite at least one financial expertise required on the board, there are no policies that specify the mix of skills and knowledge for an effective board. As a result, examining FTSE 350 companies provides meaningful evidence of the board expertise diversity in the knowledge-based disclosure context.

This study is based on the agency theory and resource dependence theory in terms of the independent role of outside directors and the diversity of resources, ensured by the presence of diverse expertise on a supervisory board. The sample used for this study covers 173 FTSE 350 companies in 2017/2018, two years since the implementation of SRs in the UK. The intense nature of the disclosure data collection was involved in the different attributes (i.e. overall, category, static, dynamics and connectedness) of IC disclosure narratives with meanings and is distinct from what the extant disclosure literature has examined. Thus, this study uses only one year of hand-coded data by content analysis approach.

To examine the relation between the expertise of a supervisory board[4] and IC disclosure narratives, the regression analyses show three main results. First, nonaccounting ENEDs are positively associated with the level of IC disclosure, whereas the increase of accounting experts on the board leads to decreased IC disclosure. Second, board independence itself shows no effect on IC disclosures. Third, IC-related information in *dynamic* notion has no relation with ENEDs except that the negative effect of accounting ENEDs remains. Moreover, nonaccounting ENEDs play a key role in improving IC disclosures of connecting with strategy and/or across categories.

[4] A supervisory board is independent of the management team, namely outside/supervisory directors in some literature. Following the European Commission Recommendation on the role of non-executive or supervisory directors of listed companies and on the committees of the (supervisory) board (2005/162/EC), we use outside directors to seek independent professional advice on the disclosure issues falling into information transparency. In this study, a supervisory board consists of outside directors, including both dependent non-executive directors (NEDs) and independent NEDs.

The results of this study provide the following contributions. First, no prior studies have examined the narratives of IC disclosure in SRs since the move to SR requirements was implemented in 2014. Information in SRs is primarily a decision that emanates from the board and has served the need of shareholders (FRC 2018a), which is an important reporting regime to examine. Second, these results are consistent with the continued trend in the literature which suggests an integrated agency-resource dependence perspective on board functions (Adams and Ferreira 2007; Tao et al. 2019; Nadeem 2020). In this study, both board monitoring and advising are explicitly considered and other corporate governance variables such as board independence, ownership concentration and board meeting are included as control variables in the regression analysis. It enhances the understanding of the dual role (i.e. monitoring and advising) of outside directors and attempts to explain the possible opposition to agency theory predictions in the literature. Third, there was a dearth of research on the effects of CG mechanisms on IC disclosure in the UK context over the past decade, especially no IC studies that underline the dual role of board directors. We offers new evidence on the impact of board expertise diversity (empirically grounded the roles of monitoring and advising) on such disclosure in the UK.

Further, prior IC disclosure studies largely focus on a single dimension of narratives (e.g. Li et al. 2008; Baldini and Liberatore 2016; Salvi et al. 2020). Being motivated by Beattie and Smith (2013) and Beattie (2014) where the concepts of connectivity on narrative disclosures are emphasised, we investigate the content of IC disclosure narratives in different attributes (i.e. category, notion and connectedness). This study provides a holistic understanding of IC narratives and responds to the future trend of corporate reporting in communicating IC information (Beattie and Smith 2013; IIRC 2013; Beattie 2014).

Finally, while the UK regulatory authorities are favoured with the combination of knowledge and independence in board effectiveness, our results suggest that increased monitoring by independent and accounting NEDs reduces IC disclosures. This finding has implications for UK companies and governance authorities since governing reliance on outside directors with financial or accounting expertise is evident. The importance of this study is also highlighted by the fact that the recent financial scandals in the UK require great transparency (Hope 2016; Eley 2019).

The rest of this paper is organised as follows. The next section discusses the theoretical framework applied to this study. "Related literature and hypothesis development" section reviews the related literature and develops our hypotheses. "Empirical methods" section explain our empirical methods. Empirical results and discussions are presented in "Empirical analysis and results" section, and the conclusion is provided in "Conclusion" section.

Theoretical framework

Research into the role of board of directors integrates agency theory and resource independence theory (RDT) into an explanatory framework in order to understand the outside directors' monitoring and advising process. Jensen and Meckling (1976) put agency relationships expounded into corporate governance mechanisms that link with the functions of a monitoring board. Specifically, the board is a control mechanism of aligning the interests of investors with management (Jensen and Meckling 1976). In the principal–agent relationship, managers tend to hold more information in order to maximise their own benefits, and thus, information asymmetry increases, especially in intangible-intensive companies (e.g. Eisenhardt 1989; Aboody and Lev 2000; Li et al. 2008). By this logic, more IC information would be disclosed by firms to serve shareholders' interests if being effectively monitored by the board. Given that outside directors are considered as 'independent' in dealing with agency conflicts at firm level (Vafeas 2003), the current study formulates the logic of agency theory that helps to explain the role of monitoring in a board over the information supply in such agency relationships.

On the other hand, resource dependence theory explains the board governance behaviour to its ability for providing the firm with the required resources from its external environment (Hillman et al. 2009). As Pfeffer and Salancik (2003) argued, the board of directors enriches the external resources a firm can reach, such as information in forms of advice, accessing to information channels and legitimacy. Under this view, RDT helps to understand how an effective board is established concerning the resources a firm utilises. It suggests that the board of directors, at 'the apex of internal control system', sustains external resources for developing corporate strategy and managerial activities (Fama and Jensen 1983). Further, Haniffa and Cooke (2002) find that outside directors hold external resources by their networking, prestige and skills. Therefore, a higher presence of expertise on the board is essential as it rises the abilities of obtaining resources and providing opinions.

From the agency–RDT framework, the increased board independence (explained by agency theory) as a result of higher proportion of outside directors may not reflect the rationale of RDT until the outside directors are able to provide expertise related to managerial decision-making (Hillman et al. 2000). In other words, firms having more outside directors' expertise are more likely to promote the gathering of IC-related resources since the board is more knowledgeable to be effective in monitoring management and reaching a high level of transparency. This would strengthen the dual role (i.e. monitor and advisor) of outside directors in responding to shareholders' interests.

A board of directors plays an important role in monitoring and advising management on behalf of external owners (Healy and Palepu 2001). Diversity in board directors' expertise, in terms of a specific or functional profession, provides the firm with a set of different knowledge and competences and an ability to monitor (Wang et al. 2015; Charitou et al. 2016; Chen et al. 2020). On the knowledge-based nature of IC, the advisory role of a board may have advantages over the board's monitoring function, albeit emphasising how board monitoring mechanisms reduce information asymmetry. In the study of Spencer (1983), the role of outside directors should be more on advisory than decision-making on corporate policies, in that their expertise and experience are fully acknowledged to contribute to board effectiveness. Accordingly, IC information disclosed by firms depends on not only the outcome of corporate governance functions, but also the knowledge building of a supervisory board in a business context.

According to Adams and Ferreira (2007), however, the effective of an advisory role on the board depends critically on information shared by the CEO. In the model of Adams and Ferreira (2007) and Adams et al. (2010), concerning the role of monitoring, managers may stifle the information sharing on the board when they perceive a board that monitors too much. In such case, boards with a more advisory role encourage information exchange and communication between the management and the board. Nevertheless, the presence of different types of expertise on the board may have different incentives on information sharing to the board because of their different focuses. Such a view has been evidenced by Gray and Nowland (2017) associating with firm value and performance.

The UK CG Code recommends the board to have a good combination of skills, experience and knowledge in ensuring a sound information environment for capital markets (FRC 2018b). In particular, the Code requires one member of the audit committee with financial experience (FRC 2016, 2018b); at the same time, many boards in the UK have followed the recommendations to appoint directors with relevant expertise and its effects become an empirical concern. Therefore, we take an integrated view of RDT and agency theory by emphasising ENEDs on the board, as well as assuming that the dual role of a board can be best exercised to reduce information asymmetry between managers and shareholders in the UK context.

Related literature and hypothesis development

Based upon the arguments of agency theory, many studies have empirically examined board composition (i.e. NEDs or independent NEDs) in different types of

voluntary-based disclosure, but the results are quite mixed. For example, Cheng and Courtenary (2006), Lim et al. (2007), and Xiao and Yuan (2007) all report a positive relationship between the proportion of independence NEDs and voluntary disclosure quantity in Singapore, Australia and China, respectively. Cerbioni and Parbonetti (2007), Li et al. (2008; 2012) and Muttakin et al. (2015) find that a higher presence of board independence leads to higher IC disclosure by examining UK, European and Bangladesh markets, respectively. In particular, board independence does a positive impact on CSR disclosure in many studies (e.g. Jizi et al. 2014; Kaymak and Bektas 2017; Fernández-Gago et al. 2018; Qa'dan and Suwaidan 2019).

However, Ho and Wong (2001), Mangena and Pike (2005), Taliyang and Jusop (2011) and Baldini and Liberatore (2016) who examined Hong Kong, Malaysia and worldwide markets, respectively, find no relationship between NEDs and information disclosure. In addition, Eng and Mak (2003), Said et al. (2009), Allegrini and Greco (2013), Tejedo-Romero et al. (2017) and Rodrigues et al. (2017) find that a higher proportion of NEDs on the board results in less disclosure quantity in the samples of Singapore, Malaysia, Italy, Spanish and Portugal, respectively. Given the mixed results in the prior literature for the increased monitoring role from 'independence', it is suggested that the effectiveness of outside directors may vary with their expertise in terms of certain business environments. This draws our focus on the expertise diversity of outside directors that is explained by both agency theory and RDT in corporate disclosure behaviour.

Board expertise is argued to be more important for affecting IC disclosures given that IC as a knowledge domain is likely developed and better communicated by knowledge-rich individuals (Chi et al. 2014). Focusing on board expertise has been empirically justified given the fact that corporate outcomes (e.g. disclosure, performance) are influenced by directors' expertise, such as individual experience (Haniffa and Cooke 2002; Gul and Leung 2004), accounting qualifications (Haniffa and Cooke 2002; Agrawal and Chadha 2005; Felo 2009), qualifications or experiences in legal and consulting (Krishnan et al. 2011), and academic qualifications (Francis et al. 2015). Michelon and Parbonetti (2012) and Mallin and Michelon (2011) argue that distinctive qualifications of board members contribute differently to board functioning and priorities. Further, Fedaseyeu et al. (2018) suggest that directors' qualifications influence the roles they play on the board. Thus, we examine the association between different types of ENEDs and IC-related disclosures, with four hypotheses proposed: *cross-directorship* for directors' experience, and three types of qualification in *accounting*, *nonaccounting* and *academia* for the knowledge and skills of NEDs.

Cross-directorships

A common practice to examine board expertise is to adopt cross-directorships that exist when directors sit on more than one board (Dahya et al. 1996; Haniffa and Cooke 2002). Directors who sit on multiple boards are considered to have reputations and experiences as experts (Fama and Jensen 1983), and have more opportunities to promote the informal coordination of firm activities and transactions (Dooley 1969; Pennings 1980). In particular, Dahya et al. (1996) show that multiple directorships are important in increasing information transparency as those directors offer multiple insights and diverse comparisons upon gained expertise in other organisations. A recent study from Kim (2022) provides the evidence that firms with busy directors on the board are likely to have a higher advising quality.

Empirically, cross-directorships have been much explored in disclosure literature. For example, Haniffa and Cooke (2002) find a positive association between proportion of directors on board with multiple directorships and voluntary disclosure and argue that cross-directorships have important implications for disclosure practice. Gul and Leung (2004) find that the multiple directorships of NEDs moderate the relationship between the CEO duality and voluntary corporate disclosures. Through analysing IPO reports, Cardi et al. (2018) find that cross-directorships increase IC disclosure in customers, processes and human resources. Similarly, Muda (2017) identified board members' cross-directorship as a significant factor in affecting the disclosure of Sharia supervisory board's report, while Rupley et al. (2012) find that board members serving on multiple boards are positively associated with the quality of environmental disclosure. In contrast, Jackling and Johl (2009) argue multiple directorships as a reduced effort from the board and find a negative relation to firm performance. Following the research on disclosure, we predict that a board with more cross-directorships enhances IC disclosure, and formally hypothesise:

H1 Ceteris paribus, there is a positive association between proportion of outside directors with cross-directorships and the level of IC disclosure.

Accounting qualification

The most commonly adopted proxy for board expertise in relation to corporate disclosure is the proportion of accounting experts on boards. McDaniel et al. (2002) find that accounting experts put information relevance at the heart of reporting process and consider forward-looking information as an important way to improve relevance for investors. Prior disclosure studies that examined the presence of accounting expertise on audit committees find a significant positive effect on interim financial disclosure (Mangena and Pike

2005) and CSR disclosure (Pfeffer and Salancik 2003; He and Yang 2014; Naheed et al. 2021), but a negative effect on IC disclosure (Li et al. 2012). Their findings indicate that research on accounting expertise should be extended to board level because the duties of audit committee may limit their focus on accounting issues. Other studies examine the accounting expertise on the board, such as Yermack (2006) who finds stock price reactions to be sensitive to directors' professional accounting and financial qualifications; Haniffa and Cooke (2002) who find a positive correlation between voluntary disclosure and board members with accounting education; and Felo (2009) who finds firms having more independent directors with financial expertise to be more transparent with their disclosure of firm performance.

On the other hand, Klein (2002) argues that accounting experts can be 'arbitrators' between internal and external auditors to reduce the agency conflicts between managers and shareholders. DeZoort and Harrison (2018) report that accountable accountants work actively against fraud and corruption than anonymous auditors. As such, the increased number of accounting experts on boards contributes to a strong monitoring role. According to Adams and Ferreira (2007), therefore, managers may be reluctant to share more information with the board because of perceived intensity with respect to monitoring managerial behaviour. In reflection, we do not specify the sign of the relation between accounting ENEDs and IC disclosure, and have the hypothesis:

H2 Ceteris paribus, there is an association between proportion of accounting ENEDs on the board and the level of IC disclosure.

Nonaccounting qualification

AIMR (Association for Investment Management and Research, 1999, cited in McDaniel et al. 2002) takes the position that a background from accounting or finance is not sufficient to ensure comprehensive disclosure and finds that individuals without formal financial training could be more insightful than those formally trained in accounting or finance. Yermack (2006) further argues that boards of diversified companies seek expertise from various backgrounds, while directors with other qualifications are likely to bring more structure with diverse insights to discussions of reporting nonfinancial information compared to directors having accounting qualifications (McDaniel et al. 2002). Gray and Nowland (2017) examined 8791 directorships in 1548 ASX-listed companies in 2007 and suggested that diversity business specialists on the board have potentials to produce more effective corporate outcomes and benefit to shareholders.

More specifically, a director with marketing expertise contributes to the disclosure of relational capital information, and HR experts on the board promote human capital disclosure. Drawing upon agency theory and RDT, Mullins (2018) uses a sample of 423 listed US firms from 2002 to 2006 and finds that firms with HR expertise on the board have stronger management on human capital. Under this view, we argue that the more the nonaccounting ENEDs on the board, the greater the likelihood that a firm would go beyond traditional accounting and disclose more value relevant nonfinancial information. In contrast to accounting experts (who have a clear duty for monitoring), nonaccounting experts on the board are more likely to encourage information sharing from the management during the firm's reporting processes. Therefore, we develop the following hypothesis:

H3 Ceteris paribus, there is a positive association between proportion of nonaccounting ENEDs on the board and the level of IC disclosure.

Academic qualification

Forbes and Milliken (1999) call for a deep understanding of what makes corporate boards effective. They suggest that the aspects of board functioning can be improved by hiring academics on the board. Pursuant to agency and resource dependence theory, Swift (2018) shows that firms with higher proportions of PhD scientists on the board produce more innovative outputs and efficient monitoring. Prior empirical studies also indicate that academics can contribute to the influencing factors of firm performance. For example, Cho et al. (2017) find that the higher proportion of academic independent directors improve CSR performance ratings, while Ujunwa (2012) and Akpan and Amran (2014) find that board directors with a PhD qualification positively impact on firms' financial performance in Nigeria. Similarly, Francis et al. (2015) find that the presence of board directors from academia is significantly and positively associated with stock price informativeness. These findings are in line with the argument of Westphal and Milton (2000) that board members with higher educational qualifications in general or with research-intensive roles provide a rich pool of innovative ideas and thoughtful perspectives on a strategic base. Thus, academic qualifications may contribute to corporate transparency.

When it comes to examining the consequences of voluntary disclosure, there is no evidence base to justify the importance of academics on boards. Martikainen et al. (2015) examine risk disclosure and find that firms with higher levels of academia on board disclose more risk-related information. Turning to the nature of IC, under the role of the board of directors, Audretsch and Lehmann (2006) argue that academics possess the intellectual capacity and trainings to serve in both monitoring and advising

Table 1 Sample selection and distribution

Panel A: Sample selection		Firms
Initial sample on FTSE350 for the period 2017–2018		350
Less: firms in the sectors of Financials and Utilities		142
Firms that are not from the UK		27
Firms listed after 1 April 2017		2
Unavailable to strategic reports		4
Missing data to firm-specific data		2
Final sample for tests		173
	%	Firms
Panel B: Industry distribution		
Basic Materials	10	17
Consumer Goods	16	29
Consumer Services	27	46
Health Care	6	11
Industrials	30	51
Oil and Gas	4	7
Technology	5	8
Telecommunications	2	4
Total	100	173
Panel C: Proportion of outside directors* on the board		
41–50	3	5
51–60	9	16
61–70	23	39
71–80	48	83
81–90	14	25
91–100	3	5
Total	100	173

*The data on outside directors (also named supervisory directors, or NEDs) were collected from BoardEx, including both dependent and independent NEDs. It was used as a base to calculate proportion of board expertise

roles, and thus can improve firms' competitive advantage. In this regard, we hypothesise a positive relationship between academics on board and IC disclosure:

H4 Ceteris paribus, there is a positive association between proportion of academic ENEDs on the board and the level of IC disclosure.

Empirical methods

Data and sample

This study starts constructing the sample size by identifying all FTSE 350 companies listed on London Stock Exchange (LSE) for the fiscal year between 1 April 2017 and 31 March 2018. The full list of FTSE 350 companies was taken at the end of 2018 edition of FTSE 350 Constituents (LSE 2018).

Table 1 presents a breakdown of sample selection (Panel A), industry (Panel B) and outside directors on the board (Panel C), respectively. In line with prior studies (e.g. Lim et al. 2007), we focus on nonfinancial companies as those in financial and utilities sectors are highly regulated and subject to different disclosure practices. We also excluded companies incorporated outside the UK[5] as these companies still use different formats and coverages for the SRs. We further excluded firms which are listed after 1 April 2017, without SR available or without necessary firm-specific data for test. As a result, our sample comprises 173 firms including eight industries, with the largest proportion of the sample in the Industrials (30%) and Consumer Services (27%), followed

[5] The FRC (2014, 2018a) requires all companies that are not small or micro-entities to prepare a strategic report. In practice, some of non-UK-incorporated companies (e.g. CRH PLC, TUI AG) still use names like 'strategic review' or 'combined management reports' with diverse coverage and formats. In order to remove ambiguity, we decide to only include UK-incorporated companies in our sample.

Table 2 Main attributes (coding scheme) of investigation

Attributes	Classification	No. of dimensions
Category	Human capital, Structural capital, Relational capital	3
Notion	Static (resources), Dynamic (activities)	2
Connectedness	Connectedness with strategy, Connectedness across categories	2

by Consumer Goods (16%) and Basic Materials (10%). Panel C of Table 1 shows that nearly half of the sampled firms have a great proportion (71–80%) of outside directors on the board.

We obtained the disclosure data from company strategic reports which have been published on the companies' websites, and manually organised and coded via using MAXQDA coding tool. We use the BoardEx database to collect board members' expertise,[6] board independence and board size data, and the companies' annual reports to gather other governance-related and firm-specific data.

Main variables

The main variables in this study are IC disclosure score and outside directors' expertise. We specify below how each of these variables is measured.

Dependent variable: attributes of IC disclosure narratives in strategic reports

As shown in Table 2, we use content analysis approach and analyse disclosure data in three attributes to IC narratives, i.e. *category*, *notion* (static and dynamic) and connectedness (connectedness across three IC categories and connectedness with strategies). Following Beattie and Thomson (2007), Li et al. (2008) and Abhayawansa and Guthrie (2014), we develop an index of 64 IC items, pertaining to a three-category scheme, namely human capital (HC), structural capital (SC) and relational capital (RC). There are 23 items in HC (e.g. employee know-how, competence, education, work-related competencies, entrepreneurial spirit, productivity, motivation and satisfaction, training and development), 19 items in SC (e.g. communication system, technologies, intellectual property, business model, operation process and efficiency, infrastructure, management philosophy, research and development) and 22 items in RC (e.g. customers, suppliers, business collaborations, business agreements). The items in our disclosure list are modified from Li et al. (2008) considering the disclosure requirements in SRs that are guided by the FRC. The developed checklist of 64 IC items based on the three-category scheme is shown in Appendix 1.

In order to explore the disclosure effect of dynamic IC narratives, disclosure data were collected under 'notion' in parallel with 'category'. We follow the basic principles in MERITUM (2002) and use the two notions: *static* and *dynamic*. *Static* information has certain features, such as result, status, situation, importance, relevance and current practices, while *dynamic* information is characterised as activity, initiative, programme, rule, guideline, policies, evaluation, etc. *Dynamic* emphasises the importance of both operational and strategic activities in relation to sustaining IC-related resources (MERITUM 2002). We construct the third attribute on connectedness to capture IC narratives through two ways: connectedness across three IC categories and connectedness with strategies. The main principles of coding IC information by notion and connectedness are presented in Appendix 2.[7]

For each of the three attributes, scoring under 'text unit' is adopted to allow information across different categories to be coded separately when items from more than one IC categories appear in a sentence (Beattie and Thomson 2007). Despite the popularity of text search, which increases the speed for data collection substantially and allows a larger sample size, it is not considered useful for this study given that single words could have no meaning in the absence of sentences or other texts (Milne and Adler 1999). Beattie and Thomson (2007) argue that IC information is meaningful in its own way, which could be missed by the word search approach. Further, visual content is also meaningful as pictures, tables, charts and diagrams have been used to communicate stories of firms' value creation (Steenkamp and Hooks 2011). We only code relevant visual content as IC disclosure when it is substantiated by word descriptions.

To build a multiple view, IC disclosure narratives are measured in three metrics—disclosure index *(ICDisc_index)* for the 'variety', frequency *(ICDisc_frqt)* for the 'focus' and word count *(ICDisc_wc)* for the 'volume', respectively. The disclosure index measure has been widely used in prior IC disclosure studies (e.g. Gray et al. 1995; Haniffa and Cooke

[6] The BoardEx Individual Profile provides biographical information about corporate board directors in relation to their employment status, professional certificates and achievements.

[7] Detailed definitions and coding instruments for each IC item are available as requested.

2002; Li et al. 2008; Whiting and Woodcock 2011; Baldini and Liberatore 2016). During the scoring, if an IC item is disclosed in either static or dynamic notion, a score of 1 is given and 0 otherwise. Similar to that of Li et al. (2008), the IC disclosure index IC Disc_index$_j$ for each firm is calculated as follows:

$$\text{IC Disc\_index}_j = \frac{\sum_{i=1}^{n_j} X_{ij}}{n_j} \quad (1)$$

where n_j = number of items for jth firm, $n_j = 128$ (i.e. 64 items in *static* or *dynamic*), and $X_{ij} = 1$ if ith item disclosed, 0 if ith item not disclosed, so that $0 \leq \text{ICDI}_j \leq 1$.

In addition to this, we measure frequency as the total number of times an IC item is present per SR. This metric is argued to signify the importance of the items disclosed (Unerman 2000) and gives a comprehensive understanding of the 'focus' on IC items disclosed in the sampled SRs. We also count the words per IC item for each presence as a third metric. *Connectedness* is measured by frequency and word count only. We used Hayes and Krippendorff's (2007) approach to examine the inter-coder reliability of our disclosure measure. The reliability coefficients were estimated for *disclosure index*, *frequency* and *word count*, and different attributes of IC narratives. Appendix 3 shows the reliability coefficients for disclosure index, frequency and word count, and coding for *category*, *notion* and *connectedness*, and explains how Krippendorff's Alpha was estimated. In general, the level of inter-coder reliability is satisfactory and justifies the coding instrument used in this study.

Experimental variables: outside directors' expertise

Data on outside (supervisory) directors, i.e. the number of NEDs, provide a base for measuring the degree of board expertise. Consistent with Haniffa and Cooke (2002), we measure cross-directorships (*CRODIR*) as the proportion of NEDs sitting on more than one board. Unlike prior disclosure studies that have widely used financial expertise in a broad definition (e.g. Li et al. 2012; Wang and Hussainey 2013; Chan et al 2013), we followed Abad and Bravo (2018)[8] to take a narrow scope of financial expertise and classified an outside director as having accounting expertise if s/he holds professional accounting qualifications such as ACCA, ACA, CIMA, CPA, AICPA, SAICA, other equivalent qualifications or certifications. We then measure accounting expertise (*ACCEXP)* as the proportion of accounting experts sitting on the board.

[8] According to Abad and Bravo (2018), an 'accounting expert' is considered to be a person who has a professional certification in accounting.

In addition, we measure the proportion of nonaccounting experts on board following McDaniel et al. (2002) who argue that firms with other experts (i.e. nonaccounting) are likely to discuss nonfinancial-related information, while information provided by BoardEx on individual directors' qualification enables us to identify nonaccounting ENEDs. This measure contributes to few disclosure studies (e.g. Bozanic et al. 2019) which focused on nonaccounting expertise. Thus, an outside director is identified as nonaccounting expertise (*NEXP*) if s/he holds a professional qualification in nonaccounting fields such as personnel and development, marketing, engineering, architecture, surveyor or other areas qualified. The fourth variable, *ACAEXP*, proxies the academic expertise of board members. Similar to Ujunwa (2012), we measure *ACAEXP* as the proportion of directors having obtained a PhD degree.

Control variables

To test the hypotheses on the relationship between ENEDs and IC disclosure, we control for several factors that are likely to influence corporate disclosure, drawing on prior disclosure studies regarding CG control mechanisms and firm-specific variables.

Other corporate governance control mechanisms

The supervisory board does not function in a CG vacuum. The effective of corporate reporting process is embedded in the CG process. Indeed, the outside directors are jointly responsible with the overall board of directors and therefore interact with the board. As such, we also examine the impact of other CG control mechanisms on IC disclosures.

Board meeting frequency (BMF) Tricker (1984) explains that board monitoring is a function of the board, and boards of directors mainly work on activities to monitor managerial behaviour. The board activity represented by meeting frequency could be an effective monitoring mechanism in reducing agency costs because frequent meetings enable better communication between managers and the board of directors (Shivdasani and Zenner 2004). The UK CG Code recommends adequate time committed by the NEDs (FRC 2010), and thus, board meeting frequency becomes a label of sound CG practice (Khanchel 2007). In disclosure literature, Laksmana (2008) finds that a board with more time to meet leads to increased disclosure of compensation practices. Li et al. (2008) examined the effect of audit committee meeting frequency on IC disclosure and found a positive association. In contrast, Cormier et al. (2010) find no relationship between board meeting frequency and voluntary CG disclosure.

Board meeting attendance (BMA) Min and Chizema (2018) argue that board meeting attendance is important in improving the effectiveness of a governance system. Outside directors who miss board meetings frequently are often criticised as being ineffective monitors (Cai et al. 2009), because the lack of attendance at board meetings is seen as less committed towards performing their duties. As such, the time committed by individual directors to attend board meetings forms a part of the governance process of corporate disclosure. Prior studies examined the effect of board meeting attendance on firm performance find that higher board attendance strengthens a firm's performance (e.g. Carter et al. 2010; Chou et al. 2013; Lin et al. 2014). However, whether board attendance influences IC disclosure has rarely been discussed.

Share concentration (SCON) Ownership structure is an important consideration for the effectiveness of corporate governance mechanisms (Desender et al. 2013) because the structure of ownership gives rise to the degree of monitoring and thereby the levels of disclosure (Eng and Mak 2003). Fama and Jensen (1983) argue that conflicts of interest between owners and managers will be greater for firms with dispersed share ownership. In contrast, firms with high share ownership concentration are perceived to have less information asymmetry as substantial shareholders have easier access to company information than other smaller groups. In the UK, highly diffused ownership structure is common among publicly listed companies and a wide shareholder interest is given the priority (Yoshimori 1995). When substantial ownership is low, there is an increased need for monitoring and thus greater demand for information disclosure.

Board independence (INED) Another key CG characteristic that can affect disclosure decisions in SR is board independence, measured by the proportion of independent NEDs (*INED*). Agency theory suggests that the existence of independent directors on the board may have a significant impact on the effectiveness of board's monitoring activities (Fama and Jensen 1983). Empirically, board independence has been one of the most debated mechanisms in disclosure literature (García-Meca and Sanchez-Ballesta 2010), especially since the corporate scandals (Bronson et al. 2009). In the context of IC disclosure, some studies find a positive association (e.g. Cerbioni and Parbonetti 2007; Li et al. 2008, 2012; Satta et al. 2015), whereas others observe a negative association (e.g. Tejedo-Romero et al. 2017; Rodrigues et al. 2017) or no significant relations (e.gHidalgo et al. 2011; Baldini and Liberatore 2016). The mixed findings may be resulting from the lack of relevant expertise, inadequate commitment to the workloads of boards, complex board diversity and types of selected sample.

Board size (BS) Board size has been one of the core subjects in board effectiveness debates and is frequently examined in relation to voluntary disclosure (e.g. Lim et al. 2007; Mangena and Tauringana 2007). Previous studies mostly find board size to be a significant positive effect on IC disclosure (e.g. Abeysekera 2010; Hidalgo et al. 2011; Ahmed Haji and Mohd Ghazali 2013; Baldini and Liberatore 2016; Tejedo-Romero et al. 2017; Rodrigues et al. 2017), while Cerbioni and Parbonetti (2007) find a negative relation. Furthermore, Hidalgo et al. (2011) find that boards with up to 15 members have a positive effect on the disclosure of intangibles. According to Gandía (2008), a large board size allows diverse experiences and opinions and in turn increases the board's supervisory capacity for more voluntary disclosure. It is, therefore, expected that larger boards have greater resources to fulfil their duties and then lead to a greater IC disclosure.

Firm-specific variables

Drawing from previous studies, the firm-specific variables we control for are *firm size* (*SIZE*), *liquidity* (*LIQT*) and *industry type* (*INDT*). Prior studies frequently note a positive correlation between firm size and levels of voluntary disclosure (e.g. Eng and Mak 2003; Chau and Gray 2010; Baldini and Liberatore 2016). Large firms that possess more resources tend to have a wider group of external stakeholders who demand more information to reduce the information asymmetry and mitigate the conflicts of interests (Jensen and Meckling 1976; Chow and Wong-Boren 1987), and therefore, the demand for IC information is also likely to be greater. We control for firm size (*SIZE*), measured as the natural logarithm of total market value, as a proxy for a firm's information environment (Eng and Mak 2003).

A higher liquidity ratio is more likely to disclose more as Wallace and Naser (1995) argue that firms with high liquidity would display greater levels of disclosure to show the capital market that they are confident to meet short-term objectives. Hence, a firm' liquidity (*LIQT*) estimated by current assets excluding inventory divided by current liability is included. In addition, most studies (e.g. Bozzolan et al. 2003; Brüggen et al. 2009; Branswijck and Everaert 2012; Baldini and Liberatore 2016) have controlled for industry and mainly used a dummy to identify whether a company belongs a high-tech industry. Companies operating in intangible-intensive or high-tech industries are more likely to disclose information about their knowledge management performance (Goh 2005; Salamudin et al. 2010). Thus, industry type (*INDT*) is a dummy variable with a value of 1 if the company belongs to a defined high-tech sector (Whiting and Woodcock 2011), and zero otherwise.

Table 3 Variable descriptions

Construct	Variable	Description	Data Source
Dependent variables (Fiscal year ended 2017)			
IC disclosure_Overall	ICDisc_index	Number of items disclosed in the disclosure index instrument divided by 128	Strategic report
	ICDisc_frqt	Number of frequencies disclosed in relation to 64 items	
	ICDisc_wc	Number of words disclosed in relation to 64 items	
IC disclosure_Notion	ICDisc_S_index	Number of items (static) disclosed in the disclosure index instrument divided by 64 items	
	ICDisc_D_index	Number of items (dynamic) disclosed in the disclosure index instrument divided by 64 items	
	ICDisc_S_frqt	Number of frequencies (static) disclosed in relation to 64 items	
	ICDisc_D_frqt	Number of frequencies (dynamic) disclosed in relation to 64 items	
	ICDisc_S_wc	Number of words (static) disclosed in relation to the 64 items	
	ICDisc_D_wc	Number of words (dynamic) disclosed in relation to the 64 items	
IC disclosure_Category	ICDisc_HC_index	Number of items (human capital) disclosed in the disclosure index instrument divided by 46	
	ICDisc_SC_index	Number of items (structural capital) disclosed in the disclosure index instrument divided by 38	
	ICDisc_RC_index	Number of items (relational capital) disclosed in the disclosure index instrument divided by 44	
	ICDisc_HC_frqt	Number of frequencies (human capital) disclosed in relation to 23 items	
	ICDisc_SC_frqt	Number of frequencies (structural capital) disclosed in relation to 19 items	
	ICDisc_RC_frqt	Number of frequencies (relational capital) disclosed in relation to 22 items	
	ICDisc_HC_wc	Number of words (human capital) disclosed in relation to 23 items	
	ICDisc_SC_wc	Number of words (structural capital) disclosed in relation to 19 items	
	ICDisc_RC_wc	Number of words (relational capital) disclosed in relation to 22 items	
IC disclosure_Connectedness	ICDisc_CRO_frqt	Number of frequencies connected across two or three IC categories	
	ICDisc_STG_frqt	Number of frequencies connected with strategy	
	ICDisc_CRO_wc	Number of words connected across two or three IC categories	
	ICDisc_STG_wc	Number of words connected with strategy	
Board expertise			
Cross-directorship	CRODIR	Proportion of outside directors sitting on more than one board at the fiscal year end 2017	BoardEx
Accounting expert	ACCEXP	Proportion of outside directors with an accounting qualification at the fiscal year end 2017	BoardEx
Nonaccounting expert	NEXP	Proportion of outside directors with a nonaccounting qualification at the fiscal year end 2017	BoardEx
Academic expert	ACAEXP	Proportion of outside directors with a PhD qualification at the fiscal year end 2017	BoardEx
Control variables			
Corporate governance mechanisms			
Board meeting frequency	BMF	Number of meetings held by the board during the fiscal year 2017	Annual Report
Board meeting attendance	BMA	Fully attended—1; not fully attended—0 during the fiscal year 2017	Annual Report
Ownership structure	SCON	Sum of the issued share percentage held by the largest (3% or more) number of shareholders (direct and indirect) at the year end 2017 or the date of notification around the year end 2017	Annual Report
Board independence	INED	Proportion of independent non-executive directors divided by total number of directors on the board at the fiscal year end 2017	BoardEx
Board size	BS	Number of members on the board at the fiscal year end 2017	BoardEx
Firm characteristics			
Firm size	SIZE	Total assets of the firm at the fiscal year end 2017	FAME

Table 3 (continued)

Construct	Variable	Description	Data Source
Liquidity	LIQT	Current assets excluding inventory divided by current liability at the fiscal year end 2017	FAME
Industry type	INDT	Dummy variable with a value of 1 if the company belongs to a defined high-tech sector	Literature*

*The dummy variable for industry type is constructed in line with the study of Whiting and Woodcock (2011: 125)

Model specification

In order to test the relationship between ENEDs and IC disclosure, the OLS (ordinary least square) regression model is employed and specified as follows:

$$\text{IC Disc}_{i,t} = \beta_0 + \beta_1 \text{ENEDs}_{i,t} + \beta_2 \text{CG Control}_{i,t} + \beta_3 \text{Firm Control}_{i,t} + \varepsilon_{i,t} \quad (2)$$

where subscripts i and t denote firm i and year t. *ICDisc* represents the levels of IC disclosure in 'overall', 'category', 'notion' or 'connectedness' (see dependent variables in Table 3). *ENEDs* is the primary focus of this study with a set of expertise variables in cross-directorship (*CRODIR*), accounting (*ACCEXP*), nonaccounting (*NEXP*) and academia (*ACAEXP*). This model also includes CG-related and firm-specific control variables. Table 3 also outlines the details of ENEDs, along with control variables of the model.

Model 2 is estimated using OLS from a cross-sectional dataset over the fiscal year 2017 (i.e. year t = 2017) in three measures: disclosure index, frequency and word count, respectively.[9] In order to detect potential multicollinearity problems, the correlations between independent variables are reviewed and the variance inflation factors (VIF) are computed. Skewness and kurtosis tests for normality were conducted based on predicted residuals from the regression models. Moreover, the potential causality issue between ENEDs and disclosure in SRs could be less of a concern in this study because the empirical testing happens with a theoretical claim and regulatory support—the UK CG Code requires board of directors to review and approve strategic report (FRC 2018a), in which a current-year SR is released following an approval from the current-year board members.

Empirical analysis and results

Descriptive statistics

Table 4 reports descriptive statistics for the dependent and independent variables. The mean of disclosure scores for our sampled firms is 49% out of 128 (*ICDisc_index)*, 249 times (*ICDisc_frqt)* and 6,211 words (*ICDisc_wc*), suggesting a moderate level of IC disclosure environment in the UK. At the sub- levels, the main category of IC information disclosed was relational capital, followed by structural and human capital. The disclosure scores in *static* are much higher than that of *dynamic* in each of three measures, which is consistent with the observation of Beattie and Smith (2013) that firms still report IC by a focus on resource-oriented rather than activity-oriented. The mean of frequency (word count) is 15.49 (445.1) and 7.31 (240.86) for IC disclosures connected with strategies and across categories, respectively. It means that firms disclosed more on the linkage between IC information and strategy. This is consistent with the findings of Leal et al. (2016) that there was a significant and positive relationship between corporate strategic events and IC. In responding to the development of a parallel understanding of 'narrative dynamics', as discussed by Beattie (2014), the IC narratives in *connectedness* are embedded in a business context. This further indicates that SRs provide an increasingly rich reporting environment to better understand the practices of IC and encourage integrated information. Ranking for each IC item under three disclosure attributes is shown in Appendix 4.

Regarding cross-directorship, around 66% of outside directors in the sampled firms sit on more than one board (*CRODIR* with a mean of 0.66). The mean for *ACCEXP* indicates that 29% of NEDs have professional qualifications in accounting, with a minimum of 0% to a maximum of 75%. Considering that the UK CG Code requires at least one audit committee member with financial expertise, the measurement from this study seems narrow as only accounting-related qualifications were involved. The mean of *NEXP* on the board accounts for only 6% ranging from 0% in the 50th percentile to a maximum of 50%. The average proportion of directors holding a PhD degree (*ACAEXP*) is 8%, showing a similar range of dataset of *NEXP*.

For CG control variables, boards meet, on average, eight times a year ranging from 1 to 19 meetings (*BMF*) with an average attendance rate of 98% (*BMA*). The mean (median) for SCON is 38.1% (36.37%) with 5.2% at minimum, 22.92%

[9] We also run by industry fixed effect, and it does not change the tenor of our results.

Table 4 Descriptive statistics for all variables ($N = 173$, 2017)

	N	Mean	SD	Percentile				
				Min	25%	50%	75%	Max
Dependent variables								
Overall								
ICDisc_index	173	0.49	0.07	0.33	0.44	0.48	0.54	0.7
ICDisc_frqt	173	249.16	80.86	83	196	238	291	776
ICDisc_wc	173	6211	2261	2317	4680	5984	7124	16,508
Category								
ICDisc_HC_index	173	0.57	0.1	0.3	0.52	0.57	0.65	0.83
ICDisc_SC_index	173	0.71	0.12	0.37	0.63	0.74	0.79	1
ICDisc_RC_index	173	0.68	0.1	0.32	0.64	0.68	0.77	0.86
ICDisc_HC_frqt	173	54.2	22.29	14	38	51	67	148
ICDisc_SC_frqt	173	90.77	38.77	18	63	81	110	265
ICDisc_RC_frqt	173	104.18	43.2	24	72	100	123	363
ICDisc_HC_wc	173	1310.32	600.89	323	889	1208	1623	3660
ICDisc_SC_wc	173	2249.35	1131.25	512	1468	1986	2747	7072.8
ICDisc_RC_wc	173	2651.33	1192.71	488	1789	2476	3318	7678
Notion								
ICDisc_S_index	173	0.52	0.08	0.3	0.45	0.53	0.58	0.73
ICDisc_D_index	173	0.45	0.08	0.25	0.39	0.45	0.52	0.69
ICDisc_S_frqt	173	149.64	53.63	46	118	143	175	510
ICDisc_D_frqt	173	99.51	37.09	34	72	96	118	266
ICDisc_S_wc	173	3698.91	1498.66	1179.5	2722	3462	4403	11,145
ICDisc_D_wc	173	2512.09	1083.64	428	1777	2386	2987	7523.6
Connectedness								
ICDisc_STG_frqt	173	15.49	8.79	2	9	14	19	56
ICDisc_CRO_frqt	173	7.31	4.74	0	4	6	10	29
ICDisc_STG_wc	173	445.1	262.68	20	269	400	562	1657
ICDisc_CRO_wc	173	240.86	226.92	0	98	194	317	1708
Independent Variables								
CRODIR (%)	173	0.66	0.22	0	0.5	0.67	0.8	1
ACCEXT (%)	173	0.29	0.15	0	0.17	0.29	0.4	0.75
NEXT (%)	173	0.06	0.11	0	0	0	0.13	0.5
ACAEXT (%)	173	0.08	0.12	0	0	0	0.14	0.5
BMF	173	8.23	2.53	1	7	8	10	19
BMA (%)	173	0.97	0.03	0.81	0.97	0.98	1	1
SCON (%)	173	38.1	19.78	5.2	22.92	36.37	54.82	82.24
INED (%)	173	0.63	0.12	0.33	0.56	0.64	0.71	0.91
BS	173	8.72	1.83	5	7	9	10	13
SIZE (GBP in mil.)	173	7956.13	16,847.24	400.35	1295.06	2655.27	5812.82	103,577.5
LIQT	173	1.03	0.57	0.16	0.64	0.94	1.31	4.07

Winsorised all continuous variables (i.e. SIZE and LIQT) at the 1st and 99th percentiles to ensure that our results are not driven by extreme values. See Table 3 for definitions of variables

in the 25th percentile, 54.82% in the 75th percentile and 82.24% at maximum, suggesting that nearly 75% of sampled firms have concentrated share ownership less than 50%. The mean (median) of *INED* is 63% (64%), suggesting that firms go beyond the minimum required level of board independence.[10] This is a great improvement from the less than 50% observed by Li et al. (2008) who examined FTSE All Share companies. With respect to firm-specific variables, the mean (median) *SIZE* is £7956.13 (£2655.27) million, suggesting

[10] The UK CG code requires that 'at least half of the board, excluding the chair, should be non-executive directors whom the board considers to be independent' (FRC 2018b: 7).

Table 5 Correlations (Pearson) coefficients

Variables	ICDisc_index	lnICDisc_frqt	lnICDisc_wc	CRODIR	ACCEXP	NEXP	ACAEXP	sqrtBMF	BMA	sqrtSCON	INED	lnBS	lnSIZE	LIQT	INDT
ICDisc_index	1														
lnICDisc_frqt	0.696***	1													
lnICDisc_wc	0.566***	0.844***	1												
CRODIR	0.219***	0.266***	0.228***	1											
ACCEXP	− 0.223***	− 0.354***	− 0.272***	0.015	1										
NEXP	0.104	0.087	0.090	− 0.074	0.088	1									
ACAEXP	0.159**	0.250***	0.220***	− 0.021	− 0.216***	− 0.141*	1								
sqrtBMF	0.107	0.048	0.100	− 0.012	0.015	0.062	− 0.167**	1							
BMA	0.145*	0.077	0.102	0.007	0.005	0.005	0.097	− 0.132*	1						
sqrtSCON	− 0.117	− 0.231***	− 0.143*	− 0.168**	0.039	− 0.041	− 0.068	0.046	− 0.100	1					
INED	0.089	0.166**	0.204***	0.244***	− 0.080	− 0.064	0.143*	0.021	− 0.056	− 0.196***	1				
lnBS	0.216***	0.395***	0.310***	0.142*	− 0.289***	− 0.081	0.221***	− 0.262***	0.039	− 0.202***	0.278***	1			
lnSIZE	0.189**	0.468***	0.368***	0.277***	− 0.270***	0.006	0.279***	− 0.185**	0.109	− 0.397***	0.356***	0.621***	1		
LIQT	0.068	0.075	0.086	0.021	− 0.145*	− 0.030	0.219***	− 0.122*	− 0.006	0.189**	− 0.098	0.050	− 0.076	1	
INDT	0.233***	0.141*	0.147*	0.085	− 0.110	− 0.079	0.096	0.022	− 0.011	− 0.025	0.068	0.040	0.006	0.227***	1

All variables are defined in Table 3. In addition to ICDisc_fqrt and ICDisc_wc, SIZE, BS, SCON and BMF are transformed into the natural logarithm because of high skewness for a good fit into normality. Significant level at ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ in two-tailed test. The continuous variables of SIZE and LIQT are winsorised at 1st and 99th percentile

that the sample consists of large firms. About 50% of firms is considered to be at healthy level of liquidity, referring to the mean (median) value of 1.03 (0.94) for *LIQT*.

Univariate analysis

Table 5 shows the Pearson correlations of the regression variables with coefficients from two-tailed tests. All three IC disclosure measures, *ICDisc_index*, *lnICDisc_frqt* and *lnICDisc_wc*, showed a positive significant correlation with *CRODIR* and *ACAEXP*. In contrast, *ACCEXP* was negatively correlated with each IC disclosure measure, and *NEXP* showed no correlation with IC disclosure. Without the related variables that are controlled for, however, it is less meaningful to make inferences about the proposed hypotheses from the univariate results.

Of the control variables, both variables of *BMF* and *BMA* showed no significant correlation with IC disclosure. As expected, *sqrtSCON* was shown to be negatively associated with *lnICDisc_frqt* and *lnICDisc_wc*, suggesting that firms with a highly concentrated ownership did less IC information disclosure. *INED* is positively correlated with *lnICDisc_frqt* and *lnICDisc_wc*, leading to more IC disclosures. The greater disclosures in SRs are in larger firms and larger boards, which is consistent with prior studies (e.g. Cerbioni and Parbonetti 2007; Li et al. 2008). It is noted that *SIZE* and *BS* are highly correlated, indicating a fact that large firms tend to have large board size. Although the correlation coefficient between *lnBS* and *lnSIZ*E is 0.621, it is less than the threshold of 0.8[11] and thus can be included in the model.

Multivariate results

Table 6 reports the regression procedure for the association between disclosure levels (*ICDisc*) and the experimental variables, as well as the control variables.[12] Panel A of Table 6, for IC disclosure in *overall* from Models 1 to 3, shows that the coefficient for *CRODIR* is statistically significant at the $p < 1\%$ level for 'variety' (*ICDisc_index*), 'focus' (*lnICDisc_frqt*) and 'volume' (*lnICDisc_wc*), respectively. This supports H1 and is consistent with the findings of most prior studies (e.g. Haniffa and Cooke 2002; Gul and Leung 2004; Muda 2017; Cardi et al. 2018), where an increase in cross-directorships improves voluntary disclosure for firms in Malaysian, Italy, Hong Kong, Italian, etc. This confirms the need of a busy board with directors' experience, knowledge and network connections to enhance the quality of advising (Kim 2022).

Regarding the test of H2, it is perhaps not surprising that *ACCEXP* is negatively associated with IC disclosures at the $p < 1\%$ or $p < 5\%$ level. In coefficients, for an increase in accounting expert, it leads to a decrease of 0.07%, 0.43% and 0.34% in *ICDisc_index*, *lnICDisc_frqt* and *lnICDisc_wc*, respectively. The result is consistent with the findings of Li et al. (2012) and Nadeem (2020) in the IC context but different from those of studies conducted in CSR context among highly regulated industries (e.g. Pfeffer and Salancik 2003; He and Yang 2014; Naheed et al. 2021). This may be explained by the nature of accounting practices—disciplined control system—the view that one of the primary functions of accounting is to exercise scrutiny and visibility over managerial behaviour (Morgan 1988). Such view is further supported by the theoretical work of Adams and Ferreira (2007) which state that a board's monitoring intensity is a disincentive of sharing information with the board.

Results from *NEXP* and *ACAEXP* are similar in statistical aspects to that of *CRODIR*. The coefficient on *NEXP* is 0.109, 0.418 and 0.475 at the $p < 5\%$ level, which supports H3. The coefficient of *ACAEXP* for each IC disclosure measure is still significant (supporting H4) at the $p < 5\%$ or $p < 10\%$ level. This finding is consistent with those of previous studies in the arguments of agency theory and RDT, such as Swift (2018) who find a strong impact of PhD directors on innovative outputs, Mullins (2018) who find that human capital management was significantly improved among firms with more HR expertise on boards, and more studies that examined the impact of board directors with nonaccounting expertise on corporate outcomes (e.g. McDaniel et al. 2002; Akpan and Amran 2014; Gray and Nowland 2017; Cho et al. 2017).

Among the control variables, *sqrtBMF* shows a significant positive relationship at the $p < 5\%$ level, indicating that corporate boards with frequent board meetings are more likely to encourage directors to disclose IC information. Results for *BMA* only show a significant and positive relationship with *ICDisc_index* at the 5% level, suggesting that *BMA* increases the variety of IC-related information. Consistent with prior studies (e.g. Cerbioni and Parbonetti 2007), IC disclosure is positively associated with *BS*, which confirms the resource-based rationale of focusing on a resource richness board.

However, there is no significant relationship between *INED* and IC disclosure. This is consistent with findings of most prior studies (e.g. Cerbioni and Parbonetti 2007;

[11] The rule of thumb to check multicollinearity is when the correlation is over 0.80 (Bryman and Cramer 2002).

[12] The t-statistics coefficients in parentheses were reported using the robust standard errors. For normality checks, those variables with high skewness and/or kurtosis are transferred into natural logarithm where appropriate, and consequently, residuals of each regression models from Models 1 to 13 showed normal distribution. VIFs for all variables in the regressions range from 1.05 to 2.22, suggesting that multicollinearity is not a problem. However, the collinearity between board size and firm size is still concerned. In terms of the adjusted R-squared, it confirms that the theoretical model established in this study has a good fit with the datasets.

Table 6 OLS regressions for the relation between IC disclosure and ENEDs ($N = 173$, 2017)

Dependent Variable	Pred Sign	VIF	Panel A: Model 1 to Model 3			Panel B: Model 4 to Model 9					
			Overall			Notion					
			Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
			ICDisc_index	lnICDisc_frqt	lnICDisc_wc	ICDisc_S_index	ICDisc_D_index	lnICDisc_S_frqt	lnICDisc_D_frqt	lnICDisc_S_wc	lnICDisc_D_wc
Number of Firms			173	173	173	173	173	173	173	173	173
R-squared			0.238	0.385	0.284	0.265	0.123	0.387	0.218	0.279	0.181
Adj. R-squared			0.181	0.339	0.231	0.211	0.058	0.341	0.159	0.225	0.120
Constant			− 0.0218	3.720***	6.073***	− 0.124	0.0809	2.737***	3.208***	4.996***	5.663***
			(− 0.144)	(5.704)	(8.675)	(− 0.726)	(0.363)	(3.370)	(3.272)	(5.519)	(5.292)
CRODIR	+	1.17	0.0651***	0.263***	0.248**	0.0955***	0.0348	0.317***	0.192*	0.296**	0.209
			(2.95)	(2.70)	(2.17)	(3.590)	(1.308)	(2.951)	(1.710)	(2.450)	(1.497)
ACCEXP	?	1.19	− 0.0700**	− 0.431***	− 0.344**	− 0.0788**	− 0.0613	− 0.425***	− 0.465***	− 0.312*	− 0.426**
			(− 2.278)	(− 3.364)	(− 2.201)	(− 1.996)	(− 1.629)	(− 2.961)	(− 2.660)	(− 1.779)	(− 2.003)
NEXP	+	1.06	0.109**	0.418**	0.475**	0.158***	0.0601	0.496**	0.373	0.624**	0.372
			(2.542)	(1.997)	(2.005)	(3.593)	(1.043)	(2.209)	(1.466)	(2.425)	(1.340)
ACAEXP	+	1.24	0.0760*	0.363**	0.389*	0.100*	0.0519	0.437**	0.299	0.558**	0.166
			(1.656)	(2.308)	(1.811)	(1.657)	(1.020)	(2.390)	(1.535)	(2.287)	(0.625)
sqrtBMF	+	1.14	0.0286**	0.121**	0.164**	0.0364**	0.0207	0.126**	0.120*	0.152**	0.205*
			(2.492)	(2.581)	(2.583)	(2.489)	(1.427)	(2.388)	(1.669)	(2.568)	(1.857)
BMA	+	1.05	0.298**	0.395	0.956	0.373**	0.222	0.79	0.0631	1.510*	0.322
			(2.057)	(0.654)	(1.610)	(2.435)	(1.074)	(1.031)	(0.073)	(1.948)	(0.357)
sqrtSCON	−	1.25	− 0.00143	− 0.0122	0.000437	− 0.00245	− 0.000416	− 0.0181	− 0.00505	− 0.00218	− 0.000654
			(− 0.413)	(− 0.941)	(0.028)	(− 0.621)	(− 0.0937)	(− 1.270)	(− 0.286)	(− 0.120)	(− 0.0320)
INED	+	1.24	− 0.0191	− 0.148	0.122	0.018	− 0.0562	− 0.131	− 0.183	0.182	0.011
			(− 0.474)	(− 0.803)	(0.553)	(0.359)	(− 1.138)	(− 0.647)	(− 0.751)	(0.761)	(0.037)
lnBS	+	1.79	0.0647**	0.272***	0.256*	0.0906**	0.0387	0.304***	0.231	0.261*	0.271
			(2.197)	(2.884)	(1.941)	(2.454)	(1.017)	(2.810)	(1.521)	(1.674)	(1.479)
lnSIZE	+	2.22	− 0.00358	0.0575**	0.0483	− 0.0118*	0.00466	0.0507*	0.0649*	0.0387	0.0620*
			(− 0.595)	(2.421)	(1.571)	(− 1.713)	(0.587)	(1.939)	(1.921)	(1.080)	(1.692)
LIQT	+	1.22	− 0.00175	0.0165	0.0302	0.0102	− 0.0137	0.0214	0.0136	0.0342	0.0383
			(− 0.234)	(0.47)	(0.61)	(1.165)	(− 1.404)	(0.686)	(0.249)	(0.738)	(0.570)
INDT	+	1.09	0.0265***	0.05	0.0628	0.0237**	0.0292**	0.0929**	− 0.00248	0.0966*	0.0163
			(2.761)	(1.305)	(1.290)	− 2.124	− 2.392	− 2.203	(− 0.0455)	− 1.801	− 0.244

Table 6 (continued)

Dependent Variables	Pred. Sign	VIF	Panel C: Model 10 to Model 13			
			Connectedness			
			Model 10	Model 11	Model 12	Model 13
			lnICDisc_STG_frqt	lnICDisc_STG_wc	lnICDisc_CRO_frqt	lnICDisc_CRO_wc
Number of Firms			173	173	173	173
R-squared			0.237	0.189	0.256	0.180
Adj. R-squared			0.180	0.128	0.199	0.119
Constant			1.911	2.510*	− 1.319	0.454
			(1.450)	(1.717)	(− 0.743)	(0.164)
CRODIR	+	1.17	0.195	0.108	0.237	0.24
			(1.08)	(0.55)	(1.15)	(0.78)
ACCEXP	−	1.19	− 0.0241	0.108	− 0.750**	− 1.305**
			(− 0.0978)	(0.316)	(− 2.545)	(− 2.572)
NEXP	+	1.06	1.062***	1.118**	1.262***	1.220*
			(2.704)	(2.441)	(3.322)	(1.917)
ACAEXP	+	1.24	1.152***	0.783**	0.750**	0.838
			(3.424)	(2.163)	(1.999)	(1.375)
qrtBMF	+	1.14	0.0576	0.197	− 0.0138	− 0.274
			(0.654)	(1.529)	(− 0.122)	(− 1.096)
BMA	+	1.05	− 1.04	0.38	2.563	5.247*
			(− 0.861)	(0.303)	(1.554)	(1.722)
sqrtSCON	−	1.25	− 0.0263	0.00117	− 0.0165	− 0.00612
			(− 0.932)	(0.0356)	(− 0.531)	(− 0.114)
INED	+	1.24	− 0.55	− 0.0897	− 0.393	− 0.632
			(− 1.382)	(− 0.162)	(− 0.891)	(− 0.902)
lnBS	+	1.79	0.634***	0.789***	− 0.255	− 0.149
			(2.645)	(2.769)	(− 0.851)	(− 0.366)
lnSIZE	+	2.22	0.0224	0.0483	0.195***	0.172**
			(0.443)	(0.870)	(3.680)	(2.270)
LIQT	+	1.22	0.143**	0.126	− 0.163*	− 0.232
			(2.088)	(1.456)	(− 1.882)	(− 1.619)
INDT	+	1.09	0.126	0.164*	0.115	− 0.0359
			(1.53)	(1.76)	(1.20)	(− 0.244)

Table 6 (continued)

Dependent Variables	Pred. Sign	VIF	Panel D: Model 14 to Model 22								
			Category								
			Model 14	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22
			ICDisc_HC_index	lnICDisc_HC_frqt	lnICDisc_HC_wc	ICDisc_SC_index	lnICDisc_SC_frqt	lnICDisc_SC_wc	ICDisc_RC_index	lnICDisc_RC_frqt	lnICDisc_RC_wc
Number of Firms			173	173	173	173	173	173	173	173	173
R-squared			0.130	0.192	0.179	0.196	0.241	0.200	0.132	0.308	0.218
Adj. R-squared			0.070	0.131	0.118	0.136	0.184	0.140	0.066	0.256	0.160
Constant			0.233	2.606***	5.160***	− 0.319	1.893**	3.916***	0.605**	3.106***	5.552***
			(1.107)	(2.831)	(4.862)	(− 1.065)	(2.294)	(4.100)	(2.294)	(2.946)	(4.372)
CRODIR	+	1.17	0.0783**	0.217	0.185	0.0373	0.279**	0.319**	0.0703**	0.270**	0.26
			(2.194)	(1.343)	(1.031)	(0.941)	(2.124)	(2.045)	(2.235)	(2.097)	(1.650)
ACCEXT	?	1.19	− 0.0435	− 0.408*	− 0.422*	0.0151	− 0.356*	− 0.22	− 0.0691	− 0.515***	− 0.421*
			(− 0.770)	(− 1.754)	(− 1.728)	− 0.262	(− 1.835)	(− 0.985)	(− 1.279)	(− 2.864)	(− 1.840)
NEXT	+	1.06	0.197***	0.802**	0.830**	0.202***	0.574**	0.587**	− 0.00362	0.171	0.289
			(3.180)	(2.437)	(2.272)	(2.852)	(2.249)	(2.043)	(− 0.0571)	(0.651)	(0.922)
ACAEXT	+	1.24	0.0383	0.259	0.185	0.180**	0.661***	0.552**	0.0236	0.114	0.344
			(0.533)	(1.100)	(0.692)	(2.127)	(2.686)	(1.981)	(0.345)	(0.434)	(0.995)
sqrtBMF	+	1.14	0.00806	0.0897	0.181*	0.0259	0.128**	0.143**	0.0440*	0.141**	0.177**
			(0.449)	(1.171)	(1.763)	(1.386)	(2.281)	(2.191)	(1.951)	(2.035)	(2.062)
BMA	+	1.05	0.3	0.387	0.541	0.540**	0.883	1.694**	− 0.0519	0.128	0.716
			(1.630)	(0.449)	(0.564)	(2.156)	(1.252)	(2.136)	(− 0.193)	(0.135)	(0.629)
sqrtSCON	−	1.25	0.00161	− 0.00997	0.012	0.00513	0.0205	0.0384*	− 0.00981**	− 0.0438**	− 0.0384*
			(0.300)	(− 0.441)	(0.498)	(1.009)	(1.213)	(1.932)	(− 2.059)	(− 2.524)	(− 1.806)
INED	+	1.24	− 0.119*	− 0.187	− 0.0732	0.058	− 0.198	0.084	− 0.0657	− 0.0108	0.229
			(− 1.737)	(− 0.651)	(− 0.242)	(0.754)	(− 0.681)	(0.270)	(− 0.921)	(− 0.0415)	(0.698)
lnBS	+	1.79	− 0.0026	0.0567	0.0368	0.139***	0.201	0.246	0.0903*	0.426***	0.397*
			(− 0.0512)	(0.294)	(0.161)	(3.028)	(1.294)	(1.399)	(1.750)	(2.679)	(1.929)
lnSIZE	+	2.22	0.00191	0.062	0.0701	− 0.00421	0.0801**	0.0681	− 0.0126	0.0335	0.0184
			(0.195)	(1.402)	(1.462)	(− 0.436)	(2.344)	(1.587)	(− 1.305)	(1.075)	(0.471)
LIQT	+	1.22	0.00449	0.0574	0.0419	0.0267**	0.0734	0.0787	− 0.0251*	− 0.0521	− 0.0238
			(0.394)	(1.119)	(0.838)	(2.099)	(1.396)	(1.086)	(− 1.956)	(− 1.143)	(− 0.414)
INDT	+	1.09	0.0366**	0.143**	0.189***	0.0201	− 0.0159	− 0.044	0.0179	0.0596	0.0914
			(2.455)	(2.422)	(2.865)	(1.209)	(− 0.275)	(− 0.639)	(1.135)	(1.060)	(1.341)

See Table 3 for variable definitions. The continuous variables of SIZE and LIQT are winsorised at the 1st and 99th percentiles. The dependent variable is the level of IC disclosure in three measures (index, frqt and wc) expressed as overall, notion and connectedness. As tested, the VIFs for all variables in the regressions range from 1.05 to 2.22, suggesting the multicollinearity is not a problem. In terms of the skewness and kurtosis test for normality, residuals of each regression from Models 1 to 13 show normal distribution. The estimated coefficients are statistically significant at the ***$p<0.01$, **$p<0.05$, *$p<0.10$

Hidalgo et al. 2011; Baldini and Liberatore 2016; Nadeem 2020), which is against agency theory predictions. Although Loulou-Baklouti (2023) finds a positive relation between the proportion of external directors on boards and IC disclosure, the mean of external directors on the board in Tunisia (15.8%) is not comparable to that of the UK (63%). It was also found that there is no relationship between IC disclosure and *sqrtSCON*.

In terms of firm-specific control variables included in the model, the regression shows partial support for the relation between the level of IC disclosure and firm size (*lnSIZE*). *lnSIZE* had a significant positive association with *lnICDisc_frqt*. However, the positive relation is no longer significant or even become insignificant negative relation when size is included in *InICDisc_index* and *InICDisc_wc*. This is consistent with the findings of Cerbioni and Parbonetti (2007) that firm size was positively or negatively related to IC disclosure depending on the types/measures of IC. *INDT* had a significantly positive relation with the variety of IC information disclosed, suggesting that IC is relevant to types of industry and its disclosure can be managed at industry level. *LIQT* has no significant effect on the extent of IC disclosure.

Panel B of Table 6 presents the estimation results for the notion (i.e. static vs dynamic) of IC disclosure in three metrics. In Models 4, 6 and 8, where *ICDisc_S_index*, *lnICDisc_S_frqt* or *lnICDisc_S_wc* was the dependent variables, a strong effect of ENEDs was found. This is very similar to those results reported for overall disclosure in Panel A. In Models 5, 7 and 9, however, no evidence was found that ENEDs are helpful in driving activity-related IC disclosure except for the negative effect of accounting ENEDs on *lnICDisc_D_frqt* and *lnICDisc_D_wc* at the $p < 1\%$ or $p < 5\%$ level.

Panel C of Table 6 shows the results of ENEDs on *connectedness* of IC information disclosed. It is interesting to note that results showed a statistically significant positive association at the $p < 1\%$ level between *NEXP* and IC disclosure connected with strategies and across IC categories, respectively. We also found similar evidence on *ACAEXP* except for *lnICDisc_CRO*_wc. This finding is again consistent with Swift (2018) regarding the importance of PhD directors on the board to promote organisational strategy. This evidence on *connectedness* suggests that nonaccounting and academia NEDs play a key role in moving IC disclosure forward with the increased importance on Integrated Reporting.

Finally, the results for IC information disclosed by three categories are shown in Panel D of Table 6. We found that the level of HC, SC and RC in three metrics varies with *CRODIR*. We also found that firms with more nonaccounting ENEDs on the board disclose more information in relation to HC and SC, whereas disclosures on SC are significantly impacted by the *ACAEXT* on boards. In contrast, a large amount of information on RC was disclosed when firms have more frequent board meetings, less concentrated ownership or higher number of outside directors on board. Comparatively, nonaccounting and academia ENEDs play a key role in promoting disclosures on SC. Findings by *category* indicate that providing sufficient IC information in a wide range of topics relies on a board with different types of ENEDs. Such results further evidence the importance of board expertise diversity (Gray and Nowland 2017) in the process of corporate IC disclosure.

Robustness test

To test the robustness of results for H1, H2, H3 and H4, as reported in Table 6, we re-estimated the models for *overall* using the four expertise variables based on the whole board (i.e. including both EDs and NEDs). As presented in Appendix 5, the regression estimates support the reported results upon a supervisory board in Panel A of Table 6 except *ACAEXP*. Concerning whether the measure of 'proportion' gives strong effects, we changed 'proportion' into 'number' and found similar results (see Appendix 5).

As specified earlier, board independence is measured upon independent NEDs. We further test whether the choice of this measure leads to the insignificant results by reducing the level of board independence (i.e. calculating the proportion of NEDs on the board). As reported in Appendix 5, the insignificant effect remains.

We also excluded the control variables to test the sensitivity of the results (see Appendix 5) as Bushman and Smith (2001) argue that a set of control variables can affect the results of interested variables in regressions. By removing these control variables, results are robust with adjusted R-squared values ranging from 0.117 to 0.161.

Conclusion

The purpose of this study was to investigate the impact of board expertise diversity on IC-related disclosures among FTSE 350 companies. Although the literature has raised attentions to the benefits of having both monitoring and advising roles on boards (Adams and Ferreira 2007; Adams et al. 2010; Armstrong et al. 2010; Schmidt 2015; Kim 2022), prior disclosure studies widely found the insignificance of board independence in the opposition of agency theory. Drawing upon agency and RDT perspectives, we consider the advising role with observability to complement the monitoring role on IC disclosures. Using content analysis approach to manually collect disclosure data from strategic reports, we examined whether certain types of ENEDs could promote IC disclosures.

Overall, we find that the proportion of certain aspects of ENEDs, i.e. cross-directorship, nonaccounting and academia, have a positive association with IC disclosures. This finding is supported by the agency–RDT prediction and further explained by the model of Adams and Ferreira (2007) where the dual role of NEDs should be considered in promoting voluntary-based corporate communication. However, it was found that IC disclosures are negatively influenced when the firms have a higher proportion of accounting ENEDs. These results indicate that NEDs with a less monitoring-oriented objective (i.e. nonaccounting) encourage managers to share more IC-related information and reduce information asymmetry between managers and outside investors. Similar to other studies, we found a noneffect of board independence on IC disclosure. This suggests that board independence effect on IC disclosure is inadequate, and further indicate the needs of outside directors' expertise performed as the advising role of a board to ensure voluntary-based IC disclosure.

The analysis of this study also distinguishes IC information by different attributes, i.e. *category*, *notion* and *connectedness*. We find that the effect for disclosing static IC information is similar to those reported for the overall IC. By *category*, it reveals that nonaccounting and academic ENEDs are helpful in increasing disclosures on structural capital. Further tests into *connectedness* show that IC disclosures connected with strategies or across categories are significantly increased among firms with more nonaccounting and academic ENEDs on the board.

Our evidence has several policy implications. First, our findings signal the need of a supervisory board quality (i.e. knowledge-embraced) on corporate disclosure process. This view is consistent with the UK CG Code where a knowledgeable board tends to exert influence in promoting corporate transparency. Second, results from testing accounting ENEDs suggest a paradoxical effect in voluntary-based disclosures. In other words, increasing the number of accounting and financial experts on the board may improve internal control but may lead to a reduced supply of IC disclosures. Thus, governance policymakers could consider the presence of nonaccounting ENEDs as an incentive to improve voluntary-based disclosure environment. Third, institutions and groups involved in the development of IC management, measurement and reporting may use the findings of this research to review their works and guide them on how to promote IC disclosure aligning with the dynamic trend of corporate narrative reporting (e.g. Beattie and Smith 2013; IIRC 2013).

Further research can expand our study in several ways. First, future studies could examine the impact of board expertise on other types of voluntary disclosure (e.g. CSR, segmental narratives, management forecasts) when boards of directors face regulatory demands. Given the mixed findings of board independence effects in the literature, we encourage future work to explore more aspects/factors of the board's dual role in information disclosure. In addition, given that a board with more nonaccounting experts is shown to increase IC disclosure, the increased IC information could be attributed to either the advisory role or a combination of both advising and monitoring roles. This highlights the importance of a continued debate of the dual role of boards in performing their duties and further points to the need of qualitative research for an in-depth study in this regard. Finally, we suggest research into additional forms of board expertise for ENEDs to further enrich the research field.

Appendix 1: IC checklist

This appendix presents the IC coding checklist developed under the review of IC literature and trial works on strategic reports (SRs). The checklist of 64 items is treated as a framework to code the IC-related information in SRs.

Human Capital		Structural Capital		Relational Capital	
1	Employees	1	Intellectual Property	1	Customers
2	Employee Relations	2	Business Model	2	Customer Profile
3	Employee Equality/ Equity	3	Organisational Structure	3	Customer Relations
4	Employee Diversity/ Inclusion	4	Quality Management	4	Customer Loyalty
5	Employee Education	5	Technology	5	Customer Satisfaction
6	Employee Competence	6	Communication System	6	Customer Involvement
7	Work-related Experience	7	Management Process	7	Customer Retention
8	Employee Know-how	8	Operation Process and Efficiency	8	Channel Relations
9	Employee Attitude	9	Operation Presence and Capacity	9	Supplier Relations
10	Employee Flexibility	10	Health and Safety in Operation	10	Supplier Knowledge

Human Capital		Structural Capital		Relational Capital	
11	Employee Turnover	11	Distribution Channel	11	Corporate Reputation and Image
12	Employee Motivation	12	Knowledge-based Infrastructure	12	Brands
13	Employee Commitment	13	Company Know-how	13	Market Presence
14	Employee Recognition	14	Corporate Culture	14	Market Share and Position
15	Employee Engagement	15	Management Philosophy	15	Marketing
16	Employee Satisfaction	16	Organisational Flexibility	16	Market Knowledge
17	Employee Involvement	17	Research and Development	17	Business Collaboration
18	Employee Productivity	18	Innovation	18	Other Collaborations
19	Employee Training	19	Accreditation and Certification	19	Business Agreement
20	Employee Development			20	Financing Relations
21	Entrepreneurial Spirit			21	Financing Capabilities
22	Employee Care			22	Stakeholder Relations
23	Employee Teamwork				

Appendix 2: Main principles of coding IC information by notion and connectedness

This appendix presents the main principles established for capturing IC information in this study. It explains the operational definitions by notion (i.e. static vs. dynamic) and connectedness (i.e. connectedness across three IC categories vs. connectedness with strategies).

Panel A: Main principles of coding IC information by notion

Notion	Operational definition	Examples
Static	Communication of the static information of a company through IC. This dimension contains themes that may relate: To benefits accruing/achieving to the company due to current or past IC; To static contents in a table/image which conveys resultant meanings in the form of result, status, performance or practice. To IC that is in a qualitative or quantitative financial/nonfinancial form; To IC that is for past, current or future. Static information is generally communicated through resource-oriented IC	Per Requests
Dynamic	Communication of the dynamic information of a company through IC. This dimension contains themes that may relate: To A) acquiring externally, or developing/improving internally, B) increasing the value of existing IC resources or C) assessing, evaluating, reviewing, monitoring IC resources; To activities/actions implemented; To the nature of policy, programmes, initiatives, methods, strategies, principles, rules, guidelines or other ways. Dynamic information is generally communicated through activity-oriented IC	Per Requests

Panel B: Main principles of coding IC information by connectedness

Connectedness	Operational definition	Examples
Connectedness across three categories	Information disclosed about a firm's IC that connects across two or three IC categories in human capital (HC), structural capital (SC) and relational capital (RC)	HC + SC: We are also trialling a number of innovative solutions that will offer colleagues greater flexibility over their own work schedules (Tesco, p16).—'Employee Flexibility + Innovation' The Ashtead culture is one of the empowered entrepreneurship where staff pay just as much attention to our smaller customers as to our larger ones (Ashtead, p30).—'Employee Entrepreneurship + Corporate Culture' HC + RC: Diverse workforce allows the Group to meet better the differing requirements of our global customer base (JamesFisher, p20).—'Employee Diversity + Customer Profile' Mediclinic's reputation as a respected and trusted provider of quality healthcare services helps it to attract and retain high-quality healthcare practitioners, including doctors and nurses (Mediclinic, p56).—'Corporate Reputation/Image + Employee Turnover' SC + RC: We have established a technology partnership with TCS to improve our IT base (M&S, p3).—'Technology + Business Collaborations' Sage Business Cloud products are supported by the very latest technology, such as AI and Machine Learning, to help our customers cut the burden of administration and improve productivity (Sage, p25).—'Technology + Customer Profile'
Connectedness with strategies	Information disclosed about a firm's IC that connects with strategy. The main feature of content coded here is that IC is linked with strategy. A 'strategy' expressed through value/growth, competitive advantage, vision/mission, strategic (long-term) goals/objectives or IC strategy specific	Competitive advantage: The urgent desire of our people to develop new solutions throughout is a key differentiator for Intertek (Intertek, p18).—'Innovation' We are continually looking to refine and develop our processes and procedures to improve our operations and make our businesses more efficient. By doing so, we are able to gain a competitive advantage (Bunzl, p20).—'Operation Process and Efficiency' Strategic (long-term) objectives: Our business model is the means by which we can deliver on our strategic objectives (Sage, p15).—'Business Model' Maintaining the culture of our business, embodied in our 'key business principles' is essential to deliver our strategy and ensure the long-term sustainability of our business (Dunelm, p32).—'Corporate Culture' Value/growth: Our sustainable business strategy aligns our commercial objectives with a clear social purpose to create long-term value and meet customer expectations (Vodafone, p).—'Customer Profile' IC strategy specific: We have 26 strategically located manufacturing plants across Europe, North America, Latin America and Asia (SpiraxSarco, p12).—'Operation Presence and Capacity' Talent identified as a critical component of our People Strategy and a key enabler in the delivery of our overall business strategy (M&S, p24).—'Employee Competence' We continue to invest in our channel-driven go-to-market strategy, with new channel programmes, systems (Sophos, p25).—'Distribution Channel'

Appendix 3: Reliability coefficients from the Estimation of Krippendorff's alpha

This appendix reports the reliability coefficients estimated from Krippendorff's alpha and explains the calculation of Krippendorff's α, which is used as a measure of inter-code reliability in this study.

Reliability coefficients: Krippendorff's Alpha

Measures	Coding Level	Krippendorff's α
Disclosure index	Category in parallel with notion	0.8156
Frequency	Category	0.7927
	Notion	0.8546
	Connectedness	0.7610
Word count	Category	0.8382
	Notion	0.8469
	Connectedness	0.7279

The calculation of Krippendorff's *α*

Krippendorff (2011) explains that α takes a general form as:

$$\alpha = 1 - \frac{D_o}{D_e}$$

where D_0 is the observed disagreement among values assigned to units of analysis:

$$D_o = \frac{1}{n}\sum_c \sum_k o_{ck}\,{}_{\text{metric}}\delta^2_{ck}$$

and D_e is the disagreement one would expect when the coding of units is attributable to chance rather than to the properties of these units:

$$D_e = \frac{1}{n(n-1)}\sum_c \sum_k n_c \cdot n_k\,{}_{\text{metric}}\delta^2_{ck}$$

When coders agree perfectly, the observed disagreement $D_0 = 0$ and $\alpha = 1$, which indicates perfect reliability. When coders agree as if chance had produced the results, $D_0 = D_e$ and $\alpha = 0$, which indicates the absence of reliability. α's range is:

$$1 \geq \alpha \geq 0$$

In this study, the estimation of α is implemented by following the instruction of Hayes and Krippendorff (2007) in the support of SPSS and KALPHA macro. Here is an example of output to disclose index coding. It was observed by three coders for IC category including 23 items for HC, 19 items for SC and 22 items for RC, in parallel with IC notion. Taken together, there are 128 coding units for each strategic report to be judged. The two invited coders have one question to answer—'Given the data coded from this strategic report by the author, do you agree or disagree with each coded unit or those units not coded?' If yes, it is labelled '1', and otherwise '2'. By requesting an estimate for nominal data, the detailed output is as follows:

Matrix

```
Run MATRIX procedure:

Krippendorff's Alpha Reliability Estimate


             Alpha    LL95%CI    UL95%CI      Units   Observrs      Pairs
Nominal      .8156      .7080      .9078   256.0000     3.0000   768.0000

Probability (q) of failure to achieve an alpha of at least alphamin:
   alphamin          q
      .9000      .9548
      .8000      .3232
      .7000      .0209
      .6700      .0059
      .6000      .0001
      .5000      .0000

Number of bootstrap samples:
  10000

Judges used in these computations:
 Rater1   Rater2   Rater3

Examine output for SPSS errors and do not interpret if any are found

------ END MATRIX -----
```

Source: output from SPSS.

Appendix 4: Descriptive analysis for IC subcategories

This appendix presents descriptive statistics of IC subcategories, pertaining to the number of firms disclosing each subcategory (Panel A), frequency disclosed by sampled firms (Panel B) and word count disclosed by sampled firms (Panel C), respectively. They are analysed in S (static), D (dynamic), O (overall) and ranked by overall in column R.

Panel A: Number of sampled firms disclosing each subcategory under *notion* and *overall*

Human Capital	Index			R	Structural Capital	Index			R	Relational Capital	Index			R
	S	D	O			S	D	O			S	D	O	
Employees	168	108	170	1	Technology	159	158	168	1	Market Share and Position	161	110	167	1
Employee Training	104	162	167	2	Management Process	163	107	167	2	Stakeholder Relations	134	161	167	2
Employee Development	130	160	166	3	Operation Presence and Capacity	165	137	166	3	Market Presence	165	104	166	3
Employee Diversity/ Inclusion	156	137	163	4	Operation Process and Efficiency	129	150	162	4	Market Knowledge	165	19	165	4
Employee Recognition	161	45	163	5	Health and Safety in Operation	139	150	155	5	Business Collaboration	136	129	159	5
Employee Motivation	58	142	150	6	Innovation	137	135	150	6	Customers	143	85	153	6

Human Capital	Index			R	Structural Capital	Index			R	Relational Capital	Index			R
	S	D	O			S	D	O			S	D	O	
Employee Engagement	111	137	149	7	Business Model	143	50	148	7	Customer Profile	131	133	151	7
Employee Competence	127	96	148	8	Corporate Culture	123	95	142	8	Customer Relations	106	133	148	8
Employee Equality/ Equity	66	126	140	9	Organisational Structure	120	87	141	9	Corporate Reputation and Image	136	45	148	9
Employee Relations	77	123	138	10	Quality Management	66	102	117	10	Marketing	65	144	147	10
Employee Care	58	123	136	11	Distribution Channel	102	73	115	11	Supplier Relations	106	124	141	11
Work-related Experience	118	6	121	12	Company Know-how	91	59	108	12	Brands	114	80	124	12
Employee Turnover	71	72	104	13	Intellectual Property	78	66	98	13	Other Collaboration	87	89	124	13
Entrepreneurial Spirit	40	37	61	14	Communication System	70	45	95	14	Business Agreement	121	53	124	14
Employee Teamwork	38	36	61	15	Research and Development	64	84	94	15	Customer Satisfaction	86	86	109	15
Employee Commitment	40	6	46	16	Knowledge-based Infrastructure	77	41	87	16	Financing Capabilities	81	38	96	16
Employee Satisfaction	39	7	43	17	Organisational Flexibility	41	60	80	17	Financing Relations	43	65	88	17
Employee Flexibility	15	24	35	18	Accreditation and Certification	68	34	79	18	Customer Involvement	34	78	87	18
Employee Know-how	21	13	32	19	Management Philosophy	62	13	65	19	Customer Loyalty	31	38	54	19
Employee Involvement	9	26	32	20						Customer Retention	26	23	40	20
Employee Education	15	11	25	21						Channel Relations	27	17	37	21
Employee Productivity	12	7	17	22						Supplier Knowledge	3	1	4	22
Employee Attitude	6	4	10	23										

Panel B: Frequency in disclosing each subcategory under *notion* and *overall* among sampled firms

Human Capital	Frequency			R	Structural Capital	Frequency			R	Relational Capital	Frequency			R
	S	D	O			S	D	O			S	D	O	
Employee Development	369	934	1303	1	Operation Presence/ Capacity	2009	835	2844	1	Market Presence	1791	360	2151	1
Employees	959	213	1172	2	Health and Safety in Operation	908	1067	1975	2	Market Share and Position	1368	315	1683	2
Employee Training	308	791	1099	3	Technology	969	918	1887	3	Stakeholder Relations	495	1123	1618	3

Human Capital	Frequency			R	Structural Capital	Frequency			R	Relational Capital	Frequency			R
	S	D	O			S	D	O			S	D	O	
Employee Diversity/ Inclusion	566	483	1049	4	Innovation	959	660	1619	4	Brands	1076	372	1448	4
Employee Engagement	349	443	792	5	Operation Process and Efficiency	487	590	1077	5	Market Knowledge	1391	25	1416	5
Employee Recognition	459	71	530	6	Management Process	678	234	912	6	Customers	1223	186	1409	6
Employee Competence	339	171	510	7	Distribution Channel	525	210	735	7	Business Collaboration	691	544	1235	7
Employee Relations	188	294	482	8	Research and Development	247	449	696	8	Customer Profile	570	428	998	8
Employee Care	126	352	478	9	Organisational Structure	375	161	598	9	Marketing	144	847	991	9
Employee Motivation	79	365	444	10	Corporate Culture	351	201	552	10	Business Agreement	814	161	975	10
Employee Equality/ Equity	112	240	352	11	Business Model	439	85	524	11	Customer Relations	340	467	807	11
Employee Turnover	158	123	281	12	Intellectual Property	340	151	491	12	Supplier Relations	277	414	691	12
Work-related Experience	272	7	279	13	Quality Management	177	278	455	13	Corporate Reputation/ Image	588	60	648	13
Entrepreneurial Spirit	66	73	139	14	Company Know-how	266	95	361	14	Customer Satisfaction	417	200	617	14
Employee Teamwork	51	49	100	15	Knowledge-based Infrastructure	210	86	296	15	Other Collaboration	190	202	392	15
Employee Satisfaction	69	8	77	16	Accreditation and Certification	177	52	229	16	Financing Capabilities	173	51	224	16
Employee Commitment	58	7	65	17	Communication System	107	65	172	17	Customer Involvement	58	143	201	17
Employee Flexibility	17	33	50	18	Organisational Flexibility	55	100	155	18	Financing Relations	57	112	169	18
Employee Involvement	10	35	45	19	Management Philosophy	109	16	125	19	Customer Retention	89	43	132	19
Employee Education	32	12	44	20						Customer Loyalty	50	81	131	20
Employee Know-how	30	13	43	21						Channel Relations	49	35	84	21
Employee Productivity	22	10	32	22						Supplier Knowledge	3	1	4	22
Employee Attitude	7	4	11	23										

Panel C: Word count in disclosing each subcategory under *notion* and *overall* among sampled firms

Human Capital	Word Count			R	Structural Capital	Word Count			R	Relational Capital	Word Count			R
	S	D	O			S	D	O			S	D	O	
Employee Development	9685	29,319	39,004	1	Operation Presence and Capacity	42,671	21,720	64,391	1	Market Knowledge	81,974	590	82,563	1
Employee Diversity/ Inclusion	12,778	16,506	29,283	2	Health and Safety in Operation	25,711	38,191	63,902	2	Market Presence	40,167	7967	48,133	2
Employee Training	5727	19,319	25,046	3	Technology	21,795	18,706	40,500	3	Stakeholder Relations	12,172	31,960	44,132	3
Employee Engagement	6594	12,612	19,205	4	Management Process	31,090	5840	36,930	4	Market Share and Position	25,775	6904	32,678	4
Employees	12,235	4365	16,599	5	Innovation	19,854	11,625	31,478	5	Brands	22,005	7623	29,628	5
Employee Relations	4588	11,166	15,754	6	Operation Process/ Efficiency	10,038	11,199	21,237	6	Business Collaboration	14,790	14,122	28,912	6
Employee Recognition	12,652	2326	14,978	7	Research and Development	6472	11,193	17,665	7	Business Agreement	22,824	5273	28,097	7
Employee Care	2616	10,139	12,755	8	Distribution Channel	12,812	4756	17,567	8	Customers	21,074	3322	24,396	8
Employee Equality/ Equity	3412	7561	10,973	9	Corporate Culture	10,818	4554	15,372	9	Customer Profile	15,727	8201	23,928	9
Employee Motivation	1418	9538	10,956	10	Organisational Structure	9534	5319	14,853	10	Marketing	2590	17,642	20,231	10
Employee Competence	5441	3084	8524	11	Business Model	12,439	1367	13,805	11	Corporate Reputation and Image	15,054	1137	16,191	11
Work-related Experience	6674	106	6780	12	Intellectual Property	7231	2651	9881	12	Supplier Relations	5547	10,095	15,642	12
Employee Turnover	2620	1784	4404	13	Quality Management	3092	5355	8446	13	Customer Satisfaction	9508	4558	14,065	13
Entrepreneurial Spirit	1008	1475	2483	14	Knowledge-based Infrastructure	4796	1882	6678	14	Customer Relations	5480	8078	13,558	14
Employee Satisfaction	1611	208	1819	15	Company Know-how	4763	1807	6569	15	Other Collaboration	4633	7536	12,168	15
Employee Teamwork	993	781	1773	16	Communication System	3242	1951	5193	16	Customer Involvement	1104	3945	5049	16

Human Capital	Word Count			R	Structural Capital	Word Count			R	Relational Capital	Word Count			R
	S	D	O			S	D	O			S	D	O	
Employee Involvement	160	1133	1293	17	Accreditation and Certification	3719	908	4627	17	Financing Relations	1413	3356	4769	17
Employee Commitment	961	109	1070	18	Management Philosophy	3219	666	3885	18	Financing Capabilities	3415	1131	4545	18
Employee Flexibility	223	632	855	19	Organisational Flexibility	940	2306	3246	19	Customer Retention	1878	808	2685	19
Employee Know-how	570	235	805	20						Customer Loyalty	772	1804	2576	20
Employee Education	402	219	621	21						Channel Relations	942	783	1725	21
Employee Productivity	408	124	532	22						Supplier Knowledge	70	5	75	22
Employee Attitude	88	96	184	23										

Appendix 5: Robustness tests

This appendix presents the regression estimates for a variety of robustness tests concerning the whole board (i.e. ED&NED), absolute numbers to measure ENEDs (i.e. CRODIR_number, ACCEXP_number, NEXP_number and ACAEXP_number), a reduced level of board independence (i.e. proportion of NEDs on board) and no control variables included, respectively.

Dependent variable	ICDisc_ index	ICDisc_frqt	ICDisc_wc	ICDisc_ index	ICDisc_frqt	ICDisc_wc	ICDisc_ index	ICDisc_frqt	ICDisc_wc	ICDisc_ index	ICDisc_frqt	ICDisc_wc
Alternative measures/ variables	Board Expertise Variables—including both ED and NED			Board Expertise Variables—replacing % with Number			Board Independence—replacing INED with NED			Without control	Without control	Without control
Number of Firms	173	173	173	173	173	173	173	173	173	173	173	173
R-squared	0.247	0.406	0.292	0.224	0.381	0.291	0.242	0.383	0.288	0.138	0.26	0.181
Adj. R-squared	0.191	0.361	0.238	0.166	0.334	0.238	0.185	0.337	0.235	0.117	0.242	0.161
Constant	− 0.0275	3.671***	6.166***	0.048	4.038***	6.527***	0.0267	3.524***	5.823***	0.451***	5.326***	8.503***
	(− 0.176)	(5.782)	(8.890)	(0.296)	(6.133)	(8.855)	(0.170)	(5.383)	(7.940)	(25.160)	(73.140)	(97.770)
CRODIR							0.0633***	0.251**	0.260**	0.0728***	0.395***	0.386***
							(2.878)	(2.585)	(2.242)	(3.245)	(4.091)	(3.406)
ACCEXP							− 0.0726**	− 0.430***	− 0.329**	− 0.094***	− 0.65***	− 0.56***
							(− 2.361)	(− 3.390)	(− 2.154)	(− 2.977)	(− 4.866)	(− 3.760)
NEXP							0.102**	0.441**	0.511**	0.104**	0.485**	0.521**
							(2.297)	(2.078)	(2.121)	(2.379)	(2.156)	(2.024)
ACAEXP							0.0798*	0.336**	0.371*	0.0835*	0.553***	0.583***
							(1.747)	(2.114)	(1.691)	(1.872)	(3.389)	(2.802)
CRODIR_ ED&NED	0.0838***	0.396***	0.314**									
	(3.330)	(3.516)	(2.274)									
ACCEXP_ ED&NED	− 0.011***	− 0.049***	− 0.0408*									
	(− 2.616)	(− 3.008)	(− 1.833)									
NEXP_ ED&NED	0.0139**	0.0785***	0.0800**									
	(2.032)	(2.792)	(2.302)									
ACAEXP_ ED&NED	0.00265	0.0283	0.045									
	(0.407)	(1.213)	(1.501)									
CRODIR_ number				0.00651*	0.0380**	0.0415**						
				(1.816)	(2.532)	(2.310)						
ACCEXP_ number				− 0.0121**	− 0.061***	− 0.049**						
				(− 2.390)	(− 3.002)	(− 1.995)						
NEXP_num-ber				0.0191**	0.0818**	0.0899*						
				(2.140)	(2.055)	(1.946)						

Dependent variable	ICDisc_ index	ICDisc_frqt	ICDisc_wc	ICDisc_ index	ICDisc_frqt	ICDisc_wc	ICDisc_ index	ICDisc_frqt	ICDisc_wc	ICDisc_ index	ICDisc_frqt	ICDisc_wc
Alternative measures/ variables	Board Expertise Variables—including both ED and NED			Board Expertise Variables—replacing % with Number			Board Independence—replacing INED with NED			Without control	Without control	Without control
ACAEXP_ number				0.00841	0.0469**	0.0579*						
				(1.250)	(2.106)	(1.913)						
sqrtBMF	0.0241**	0.101**	0.149**	0.0265**	0.113**	0.156**	0.0289***	0.115**	0.163**			
	(1.975)	(2.047)	(2.213)	(2.258)	(2.394)	(2.422)	(2.656)	(2.514)	(2.532)			
BMA	0.333**	0.521	1.020*	0.299**	0.403	0.982*	0.257*	0.537	1.166*			
	(2.289)	(0.868)	(1.714)	(2.071)	(0.688)	(1.696)	(1.773)	(0.901)	(1.883)			
sqrtSCON	− 0.00211	− 0.0146	− 0.00287	− 0.00208	− 0.0147	− 0.00313	− 0.00058	− 0.0133	− 0.0041			
	(− 0.622)	(− 1.158)	(− 0.185)	(− 0.594)	(− 1.138)	(− 0.203)	(− 0.163)	(− 1.018)	(− 0.258)			
INED	− 0.0334	− 0.235	0.0544	− 0.0215	− 0.209	0.0214						
	(− 0.774)	(− 1.270)	(0.245)	(− 0.487)	(− 1.066)	(0.092)						
NED							− 0.0585	0.123	0.313			
							(− 1.026)	(0.521)	(1.122)			
lnBS	0.0776**	0.344***	0.292**	0.0479	0.187*	0.125	0.0707**	0.246**	0.225*			
	(2.514)	(3.229)	(2.097)	(1.404)	(1.661)	(0.821)	(2.281)	(2.493)	(1.664)			
SIZE	− 0.00624	0.0402	0.0326	− 0.0045	0.0475*	0.0332	− 0.00293	0.0521**	0.0453			
	(− 1.043)	(1.632)	(1.021)	(− 0.683)	(1.797)	(1.023)	(− 0.490)	(2.260)	(1.496)			
LIQT	− 0.0016	0.0137	0.0243	− 0.00167	0.0151	0.0256	− 0.00187	0.0208	0.0305			
	(− 0.219)	(0.427)	(0.511)	(− 0.216)	(0.488)	(0.558)	(− 0.243)	(0.600)	(0.655)			
INDT	0.0256***	0.0467	0.0569	0.0280***	0.0581	0.0695	0.0255***	0.0493	0.0681			
	(2.677)	(1.230)	(1.159)	(2.889)	(1.507)	(1.437)	(2.679)	(1.305)	(1.417)			

Winsorised all continuous variables (i.e. SIZE and LIQT) at the 1st and 99th percentiles. See Table 3 for definitions of variables. Robust t-statistics in parentheses. The estimated coefficients are statistically significant at the ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

Acknowledgements We thank Dr Jing Li of University of Bradford for her detailed, thoughtful and constructive comments on the development of coding rules for disclosure data collection in the paper.

Declarations

Conflict of interest We confirm that there are no known conflicts of interest associated with the publication of this paper and there has been no significant funding support that could have influenced the outcome of this work.

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